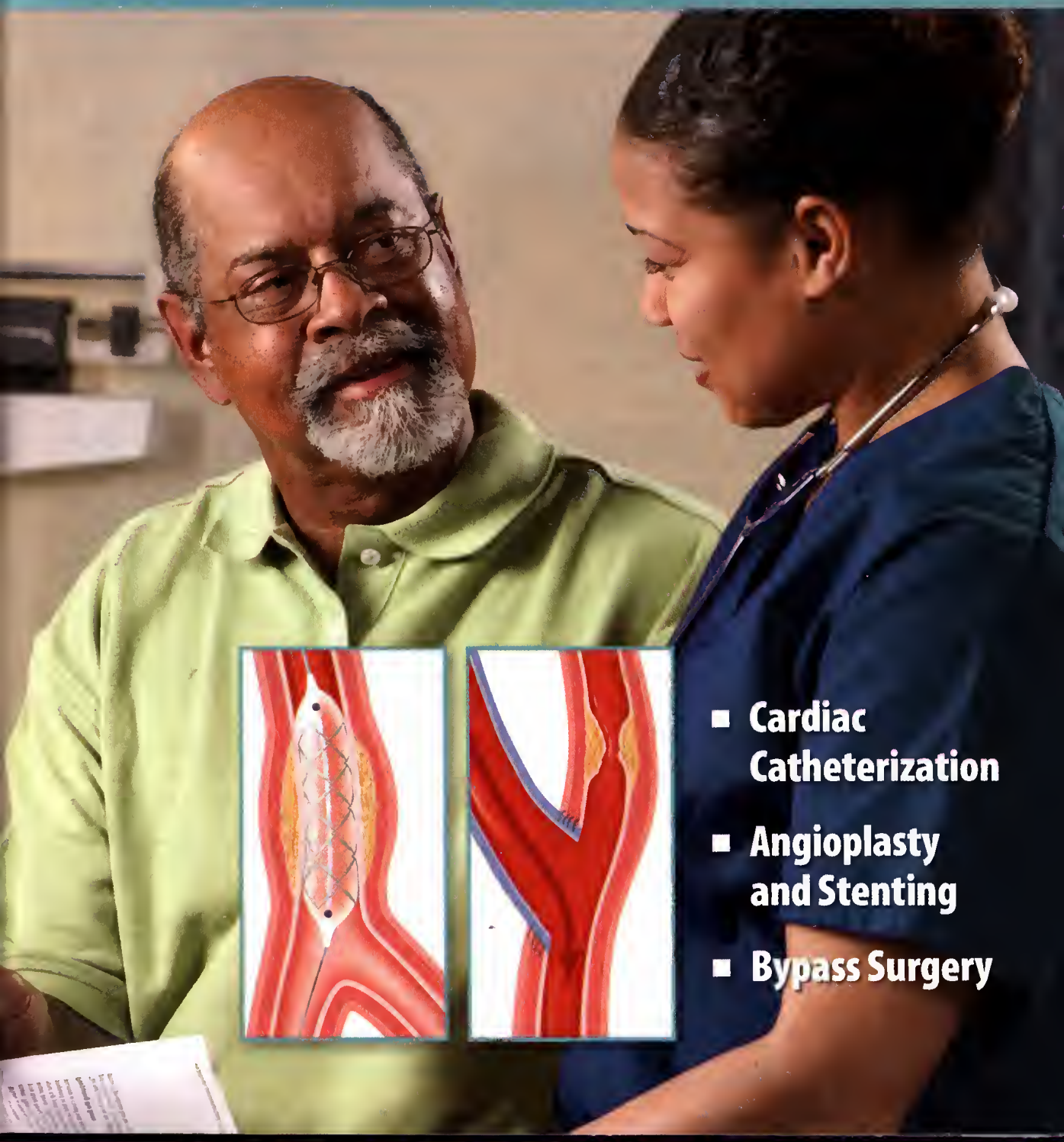
KRAMES
PATIENT EDUCATION

Understanding Coronary Artery Procedures



- Cardiac Catheterization
- Angioplasty and Stenting
- Bypass Surgery

Procedures to Help Your Heart

Your doctor has told you that you may have **coronary artery disease,** also called **CAD.** This means that vessels carrying blood and oxygen to your heart may be narrowed or blocked. Left untreated, CAD can lead to a heart attack or sudden death. The good news is that there are procedures to pinpoint and treat this type of heart problem. Reading this booklet can help you learn about coronary artery procedures. This way, you and your doctor can form a treatment plan that's right for you.

Signs of CAD

Your doctor may suspect you have CAD based on symptoms, such as chest pain or shortness of breath. Your exam and test results may also confirm certain factors that make heart disease more likely. After your evaluation, your doctor may talk with you about angina and risk factors.

Understanding Angina

Angina is often described as a painful, heavy, or tight feeling in or near the chest. But symptoms do vary from person to person. Some people feel angina in the arm, back, neck, throat, or jaw. Sweating and feeling tired or short of breath often occur along with the discomfort. Angina is a common sign of CAD.

Risk Factors for Heart Disease

Risk factors are health problems and ways of living that increase a person's chance of developing heart disease. Risk factors include high cholesterol levels, high blood pressure, and diabetes. Smoking, being overweight, and lack of physical activity are also major risk factors.

Angina often occurs during an activity that makes the heart work harder. In many people, angina produces shortness of breath.

This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.

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Diagnosing and Treating CAD

Your doctor is suggesting one or more procedures to confirm, and possibly treat, your CAD. For most people, cardiac catheterization is the best way to gather information about the coronary arteries. During this procedure, a flexible tube called a **catheter** is inserted into a blood vessel and carefully guided to the heart. Once there, the catheter is used to do tests that can locate blockages. The results of these tests help your doctor plan your treatment.

- Depending on test results, your doctor may prescribe medications and lifestyle changes to control risk factors.
- If tests show significant blockages, catheters and other devices, such as tiny balloons, may be used to widen narrowed arteries.
- If catheter-based procedures cannot be used to treat your problem, your doctor may recommend surgery. Coronary artery bypass surgery creates a new pathway around the blocked part of an artery.

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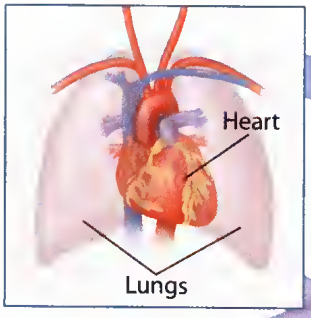
How CAD Develops

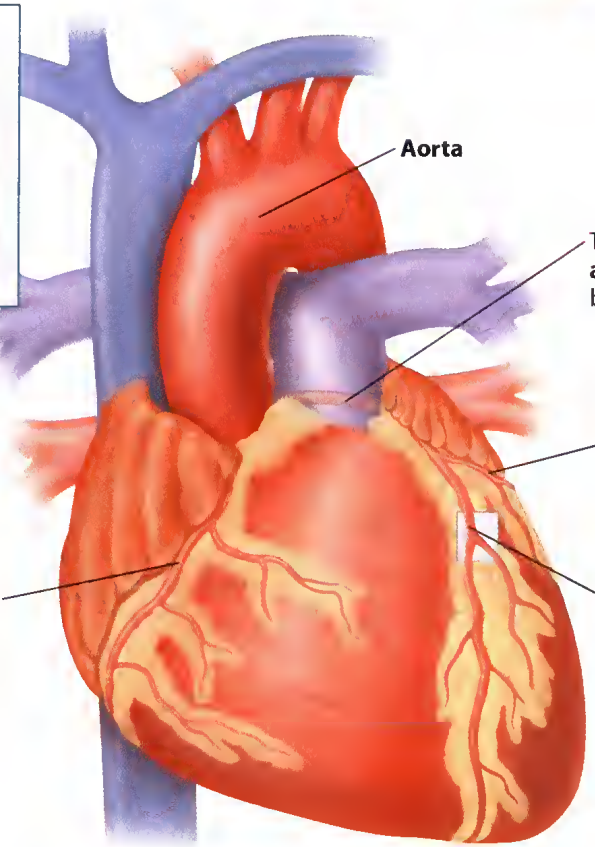
The heart is a muscle that pumps blood throughout the body. Like other muscles, the heart needs a steady supply of oxygen to function. Blood carries oxygen to the heart and the rest of the body through blood vessels called **arteries.** In the heart, the coronary arteries supply blood and oxygen to the heart muscle. If the heart doesn't get enough oxygen, angina or a heart attack can result.

Healthy Coronary Arteries

Coronary arteries wrap around the surface of the heart. Their job is to supply the heart muscle with oxygen-rich blood. The amount of oxygen the heart needs depends on how hard it's working. For example, exercise makes the heart beat faster, increasing the muscle's need for oxygen. Healthy arteries can easily meet this need. They have smooth, flexible walls that can accommodate changes in blood flow.

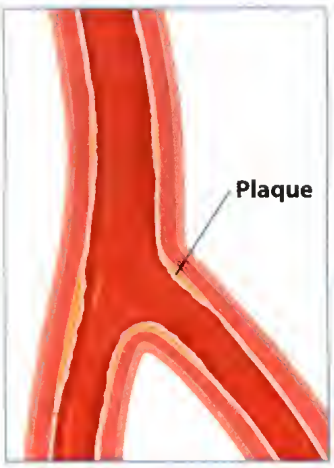


The heart is a muscle about the size of a small fist. It is located near the center of the chest.

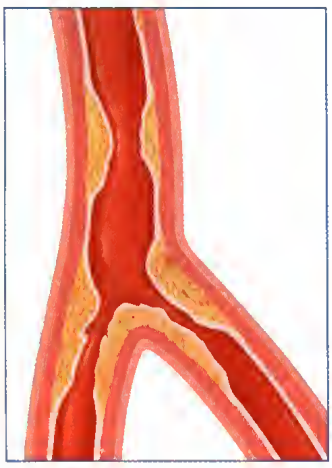


Coronary Artery Disease

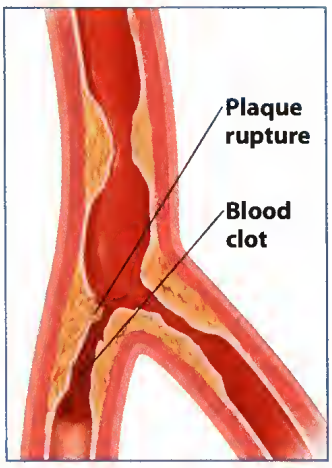
Coronary artery disease starts when the lining of a coronary artery is damaged. Having one or more risk factors, such as smoking or high blood cholesterol, can speed up and worsen this damage. Over time, **plaque** (a fatty material composed of cholesterol and other particles) builds up within the artery wall. This buildup (called atherosclerosis) narrows the space inside the artery. It also makes artery walls less able to expand. At times when the heart needs more oxygen, the increased demand for blood cannot be met. This can lead to angina.



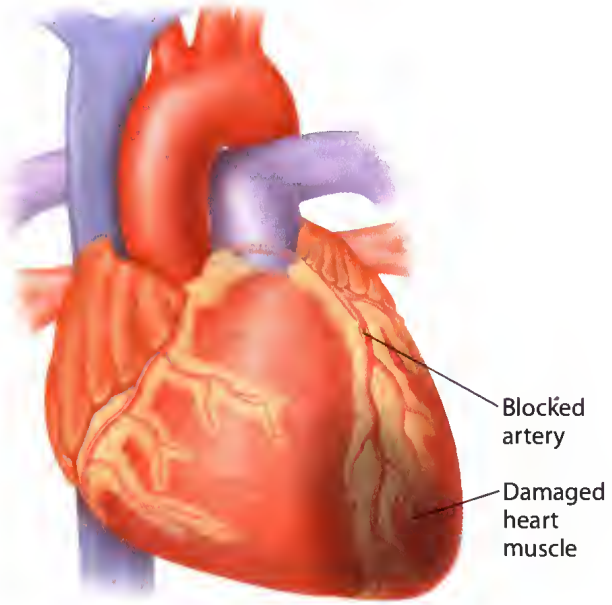
Plaque Forms
The lining of the artery is damaged. This allows plaque to form between the layers of the artery wall.



The Artery Narrows
Plaque narrows the channel where blood flows. When the heart starts to work harder, the artery can't meet increased demands for blood. This can lead to angina.



The Artery Is Blocked
Plaque deposits sometimes rupture. A rupture can narrow the artery even more. It can also cause a blood clot to form. If plaque or a blood clot cuts off blood flow in the artery, angina or a heart attack result.



Heart Attack

A heart attack (myocardial infarction) occurs when a coronary artery is blocked by plaque or a blood clot. When this happens, the heart muscle beyond the blockage doesn't receive oxygen. That part of the heart muscle dies. This damage cannot be reversed. Though many people survive heart attacks, a heart attack can be deadly.

Evaluating Your Heart Muscle

By now, you've most likely had at least one diagnostic test. Stress tests and electrocardiograms can show whether heart muscle has been damaged. They can also show how the heart responds to stress. Depending on your test results, your doctor may recommend cardiac catheterization.

Stress Imaging Tests

These tests show whether your heart pumps normally during stress. They also show whether arteries can meet an increased demand for blood. To prepare for the test, you may exercise on a treadmill to increase the heart rate. Or medication may be used to stress the heart.

- An **echocardiogram** uses sound waves to show the structure and movement of the heart.
- With **nuclear imaging,** a small amount of weakly radioactive material is injected into a vein. The material is absorbed by the heart. This enables a scanning camera to take pictures of blood flow through the heart muscle.

Electrocardiogram

An electrocardiogram (ECG or EKG) records the heart's electrical patterns. Leads (wires) are attached to your arms, legs, and chest. They are connected to a machine that shows the electrical patterns on a screen.

- A **resting ECG** is done while you're sitting or lying down. It can show whether your heart has already been damaged by a heart attack.
- A **stress ECG** is done while you're exercising on a treadmill or stationary bike. It shows how your heart responds to exercise. Tell the doctor if you feel angina during this stress test.

Preparing for Catheter-Based Procedures

Cardiac catheterization is used to confirm CAD and locate the exact site of a blockage. Depending on your results, catheters may also be used to improve blood flow. Your doctor will talk with you about the risks of all catheter-based procedures. You'll also be told how to prepare.

Before Your Procedure

Being well prepared can help you feel more at ease on the day of your procedure. Be sure to:

- Take medication as instructed by the doctor performing your procedure. New medications may be prescribed, or you may be asked to stop taking certain medications for a period of time.
- Do not eat or drink after the midnight before the procedure.
- Arrive at the hospital a little early. You will be asked to read and sign consent forms.
- Arrange for an adult family member or friend to take you home after the procedure. But be aware that you may need to stay in the hospital overnight. Pack a bag just in case.

Possible Risks

Complications of catheter-based procedures are fairly rare. Still, risks of cardiac catheterization, angioplasty, and stenting may include:

- Bleeding from the catheter insertion site
- Allergic reaction to the x-ray dye
- Abnormal heartbeat (arrhythmia)
- Tearing of the artery lining
- Kidney failure
- Emergency bypass surgery
- Heart attack, stroke, or death

Be Sure to Tell Your Doctor:

- **About any medications you take.** Include herbs, supplements, and over-the-counter medications.
- **If you are allergic to iodine or any medications.** X-ray dye used during catheter-based procedures contains iodine. If needed, you can be given medication to prevent an allergic reaction.
- **If you are pregnant or think you could be pregnant.** The procedure may be postponed until after the baby is born.

Diagnosing CAD: Cardiac Catheterization

You may feel a little nervous before your catheterization. This is normal. Your healthcare providers will do all they can to help you stay comfortable. Once prepped for the procedure, you'll be taken to the cath lab. You can expect to be in the lab for an hour or longer.

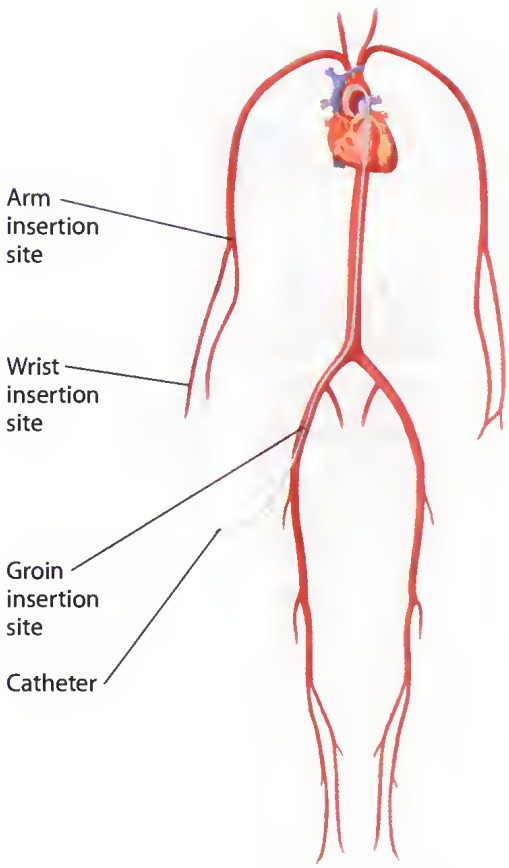
Before Cardiac Catheterization

You'll be taken to a prep room, where you'll change into a hospital gown. You'll be asked to empty your bladder and bowels. An IV line will then be started. You may be given medication or fluid through this line. Hair may be removed from the skin where the catheter will be inserted. You'll then be taken to the cath lab.

In the Cath Lab

Once in the cath lab, you'll lie on a table beneath x-ray cameras. Video monitors will be nearby. Although sedated for comfort, you'll remain awake during the procedure:

- A local anesthetic numbs skin and surrounding tissue. Then an introducing sheath is inserted into an artery in the groin, arm, or wrist. The sheath remains in place throughout the entire procedure.
- In some cases, pressures within the heart chambers are measured. This requires a second sheath in the same area.
- A catheter and guide wire are put into the sheath. They are then threaded through the arteries to the heart. This takes just seconds. Blood vessels have no pain nerves, so you won't feel their passing. Once the catheter is in place, the guide wire is removed.
- During cardiac catheterization, guide wires and catheters may be removed and replaced several times. This is done to reach each of the coronary arteries.

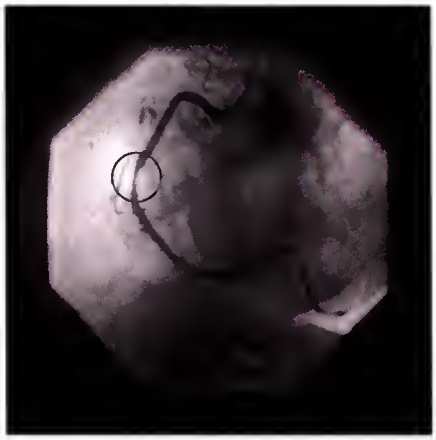


Viewing Coronary Arteries

Once the catheter is positioned in the coronary artery, x-ray dye is injected through the catheter. The dye enters the artery, allowing the blood flow channel (the lumen) to show up on x-rays. You may feel a warm flush as the dye enters your system. Several images **(angiograms)** are then taken. The angiograms show the amount of narrowing in the artery and its exact location. These details help your doctor form a plan to open or bypass blockages.

Angiography Results

During cardiac catheterization, your doctor may tell you what the angiograms show. The number, location, and characteristics of the blockages will affect treatment. In many cases, angioplasty and stenting are likely to improve blood flow. These procedures may be done right away or scheduled for a later date. If interventional procedures are not likely to succeed, your doctor may advise having a coronary artery bypass. This surgery will be planned after a separate discussion.



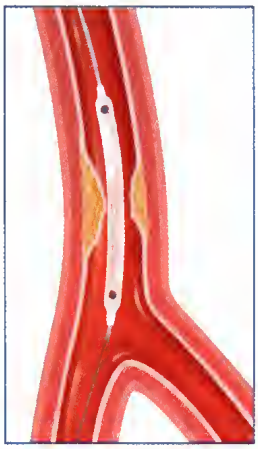
This angiogram confirms CAD. Narrowing in the artery is shown in the circle above.

Treating CAD: Angioplasty and Stenting

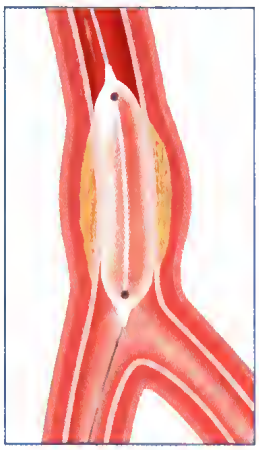
If an angiogram confirms a blockage in an artery, angioplasty and stenting may be the treatment of choice. These procedures widen the channel (lumen) where blood flows in an artery. Like cardiac cath, they are also performed in a cath lab, often right after angiography. One or both procedures may be done, depending on the blockage.

Balloon Angioplasty

For this procedure, a balloon-tipped catheter is inserted into the affected coronary artery. Once in place, the balloon is inflated. This compresses the plaque against the artery walls. As a result, the lumen is widened. When the balloon is inflated, blood flow stops for a moment. As this happens, you may have angina for a short time. Tell your doctor if you feel symptoms or discomfort. In most cases, angioplasty is followed by stenting.



A balloon is inserted into the narrowed area.



The balloon is inflated. This flattens plaque against the artery walls.

The artery is widened, improving blood flow.

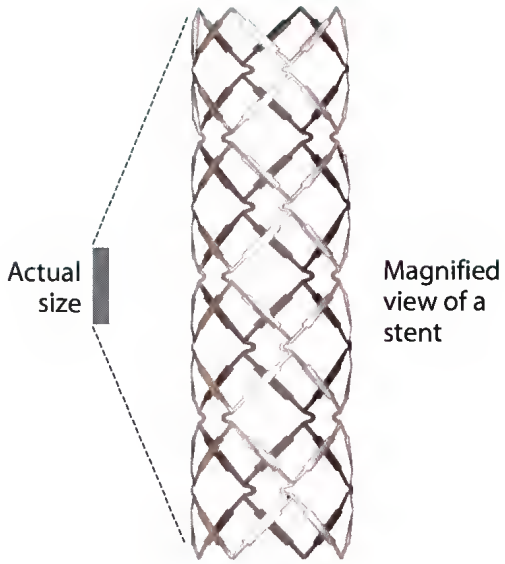
When to Call Your Doctor

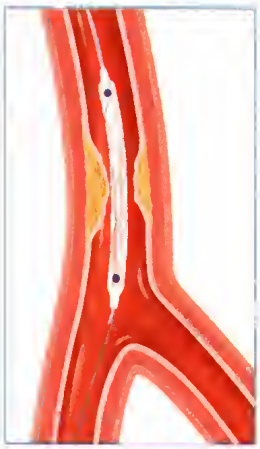
After a catheter-based procedure, call your doctor if you have any of the following:

- Increasing pain, swelling, redness, bleeding, or warmth at the insertion site
- Drainage from the insertion site
- Fever
- Angina or shortness of breath
- Inability to urinate, or blood in the urine
- Severe pain, coldness, or a bluish color in the leg or arm where the catheter was inserted

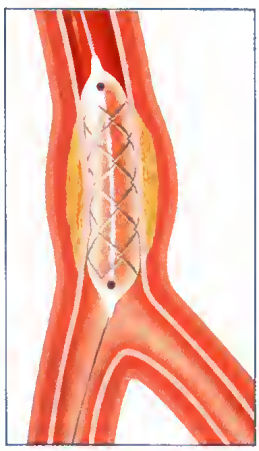
Stenting

A stent is a flexible tube made of wire mesh. The stent, in a collapsed form, is mounted onto a balloon catheter. The balloon and stent are guided across the lesion. Once in place, the balloon is inflated. This pushes plaque against the artery wall and opens the stent. The balloon is then deflated and removed. The stent remains as a permanent support, helping to hold the artery open. Some stents are **drug-eluting.** They slowly release medication over a period of time. The medication reduces the amount of scar tissue that forms inside the artery. This helps to prevent **restenosis** (a renarrowing of the artery at the same site).





A stent, loaded onto a balloon, is slid into place.



The balloon is inflated to open the stent.

The stent remains in place, holding the artery open.

Closing the Insertion Site

The sheath in your groin, wrist, or arm will be removed, and the insertion site closed. This may be done while you are still in the cath lab. Or it may be done after you have been moved to a hospital room. You may need to keep still, with your leg or arm straight, for 2 to 6 hours. How long depends partly on the insertion site and the type of closure performed. You'll be closely monitored until you're ready to go home. Most people stay in the hospital overnight.

Going Home

Many people feel relief from their heart disease symptoms right away. You can go home when:

- Your condition appears stable.
- The insertion site is not bleeding.
- Your blood tests are cleared by your doctor.
- You have no signs of infection.
- You can urinate.

Treating CAD: Coronary Artery Bypass Surgery

Sometimes angioplasty and stenting cannot significantly improve blood flow. In such cases, coronary artery bypass surgery is often advised. This procedure reroutes blood flow to the heart. To do this, a new pathway is created around the blocked part of an artery. In most cases, a blood vessel from another part of the body is used to make the bypass.

Preparing for Bypass Surgery

Members of your healthcare team will tell you how to get ready for surgery. Be sure to:

- Tell your doctor about all the medications you take. Also mention any vitamins, herbs, and other supplements you use.
- Stop taking aspirin or other medications if so directed.
- Stop eating and drinking after the midnight before your surgery.
- Take daily medications on the day of the procedure as instructed by the doctor performing the surgery.

Risks and Complications:

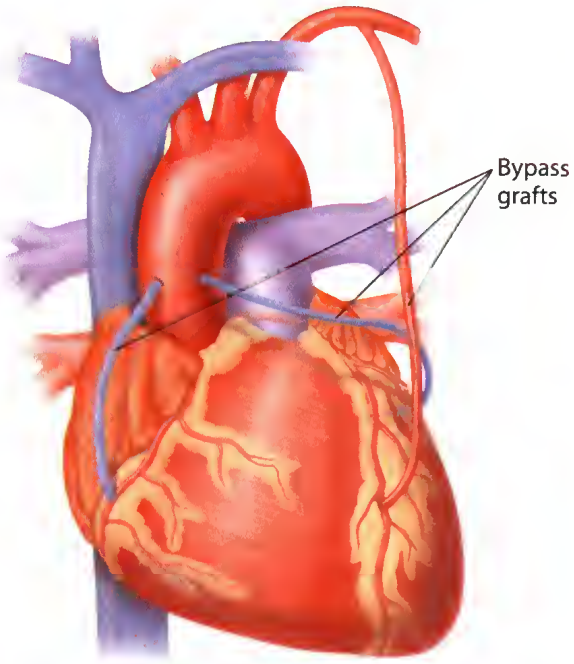
As with any procedure, bypass surgery has certain risks. They include:

- Breathing or other lung problems
- Excessive bleeding
- Wound infection
- Irregular heart rhythm
- Risks associated with anesthesia
- Heart attack, stroke, or death

Surgery to Bypass Blockages

Bypass surgery is performed in an operating room. In most cases, it takes between 3 and 6 hours. A blood vessel from the leg, arm, or chest will be used to make each bypass graft. Removing these vessels usually does not harm blood flow in the rest of the body. To reach the heart, surgeons typically make an incision down the center of the chest. The breastbone is separated. Then:

- If the bypass graft is from the arm or leg, one end is secured to the aorta above the blockage. The other end is fastened to the coronary artery past the blocked area.
- If a vessel from the chest wall is used, it is rerouted to connect to the coronary artery below the blockage.



If you have more than one blockage, more than one bypass may be needed.

After Bypass Surgery

Right after surgery, you'll be taken to the intensive care unit. (It may also be called the cardiac care unit.) When you wake up, you'll have a breathing tube in place. You'll also be connected to several devices. This is normal. These devices are used to monitor your recovery. As you become alert and stable, the breathing tube will be removed.

Beyond Intensive Care

When you no longer need constant care, you will be moved to another room. At this point, you may begin eating and taking oral medications. As soon as possible, you'll start moving around and walking. This helps boost muscle strength. It also improves blood flow and helps aid healing.

Going Home

You'll be able to go home when your doctor feels your condition is stable. Expect healing to take at least 6 to 8 weeks. You're likely to gain a little more energy and strength each day. During this time, follow up with your doctor as directed. Also be sure to:

- Take all medications as prescribed. Take the exact dose as often as instructed. Don't stop any medications without your doctor's okay.
- Tell your doctor if you have any problems after taking medications. Upset stomach, diarrhea, or skin rash might occur.
- Take care of all incisions as directed. You may be told to wash incisions with warm (not hot) water and soap. To help prevent infection, don't use ointments or lotion.

When to Call Your Doctor

After bypass surgery, any of the warning signs listed below could signal heart problems. Call your doctor if you notice:

- Shortness of breath while reclining
- Unexplained bleeding or bruising
- Wound infection
- Irregular heart rhythm
- Fever over 100°F (37.7°C)
- A weight gain of 3 pounds in a day or 5 pounds in a week

Staying Committed

Heart health is a lifetime commitment. To feel your best, make an effort to control your heart disease risk factors. Track your progress in the chart below. Seeing improvement is always a good way to stay motivated!

	My Goal	Now	In 6 months	In 1 year
Healthy Eating	*Calories per day* *Total fat (g)* *Dietary cholesterol (mg)* *Dietary sodium (mg)*			
Exercise	*Minutes per day* *Times per week*			
Smoking	*Tobacco used daily*			
Risk Factor Management	*Total weight* *Daily blood pressure* *HbA_{1c}* *Total cholesterol* *HDL cholesterol* *LDL cholesterol* *Triglycerides*			

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